MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210 & TERM ID 2215)

PSM0325 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Information Technology)

15 FEBRUARY 2023
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers must in the Answer Booklet provided.
4. All necessary working **MUST** be shown.
5. **Key Formulas and Statistical Tables** are provided.

Question 1 (10 marks)

a) Table below shows the height (in meter) of selected trees in campus.

Height (m)	Number of Students
1.20 – 1.80	3
1.90 – 2.50	5
2.60 – 3.20	12
3.30 – 3.90	17
4.00 – 4.60	3

Find the mean, variance and standard deviation of this distribution. [6 marks]

b) Given a sample of 8 scores are 54, 48, 37, x, 54, 53, 55 and 51. If the sample mean is 49.56, find x to the nearest integer. Hence, find median and mode. [4 marks]

Question 2 (10 marks)

a) Consider the probability density function for continuous random variable X,

$$f(x)=\begin{cases} k\left(1+x^2\right), & 1<x<2 \\ 0, & \text{otherwise} \end{cases}$$

i. Find the value of the constant k. [2 marks]

ii. Find $P(X>1.3)$. [2 marks]

iii. Find $P(1.1<X<1.5)$ [2 marks]

b) The data for the table below represent the marital status and gender of the residents aged 18 years old or older from a selected country.

	Males(in millions)	Females(in millions)
Never Married	23	20
Married	55	60
Widowed	4	6
Divorced	8	12

i. Find the probability that a randomly selected person is married or female. [2 marks]

ii. Find the probability that a randomly selected male is divorced. [2 marks]

Continued...

Question 3 (10 marks)

a) The number of people arriving at a bicycle repair shop follows a Poisson distribution with an average of 2 people per hour.

i. Find the probability that at most seven people arrive at the bicycle repair shop in 1.5 hours. [2 marks]

ii. Find the probability that between 2 and 8 people arrive at the bicycle repair shop in 45 minutes. [3 marks]

b) A Computer Science Department is contacting alumni by telephone asking for donation to help fund a new laboratory. Past history shows that 75% of the alumni contacted in this manner will make a contribution of at least RM50. A random sample of 15 alumni is selected.

i. What is the probability that exactly 15 alumni will make a contribution of at least RM 50? [2 marks]

ii. What is the probability that from 7 to less than 12 alumni will **NOT** make a contribution of at least RM 50? [3 marks]

Question 4 (10 marks)

a) A certain type of car battery is known to have a lifetime which is normally distributed with a mean 700 days and a standard deviation 50 days. Find the probability that the mean lifetime of the automobile in a sample of 64 batteries will be less than the population mean by 15 days or more. [4 marks]

Continued...

b) A bank with a branch located in commercial district of Melaka has developed an improved process for serving customers during the peak lunch hour of noon to 1p.m. The waiting time (operationally defined as the time from when the customer enters the line until he or she is served) of all customers during this hour is recorded over a period of one week. A random sample of 24 customers is selected, and the results (in minutes) are as follows:

4.21	5.55	3.02	5.13	4.77	2.34	3.54	3.20
3.18	4.97	5.05	2.55	4.23	4.67	4.50	5.47
4.50	6.10	0.38	5.12	6.46	6.19	3.79	5.90

Assume that the waiting time for all customers is normally distributed with a variance of 2.13 square minutes.

i. What is the point estimate and margin of error of the mean waiting time for all the customers in this branch? [3 marks]

ii. Calculate with 97% confidence the interval for the mean waiting time of all the customers. [3 marks]

Question 5 (10 marks)

A study by AQ.fm claimed that all employees of Menara Persekutuan building spend an average of RM8 or more for breakfast during weekdays. An observer wanted to check if this claim is true. A random sample of 50 employees of Menara Persekutuan building taken by this observer showed that these employees spend an average of RM7.68 for breakfast during weekdays with a standard deviation of RM2.1

a) Using 1% significance level, can you conclude that the claim that all employees spend an average of RM8 or more for breakfast during weekdays is false? [7 marks]

b) Make the test of part (i) using a 2.5% significance level. Is the decision different from the one in part (i)? [3 marks]

End of Paper

Keys Formulas

1. Ungrouped data: Mean $= \dfrac{\sum x}{n}$ Variance $= \dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n-1}$

2. Grouped data: Mean $= \dfrac{\sum fm}{\sum f}$ Variance $= \dfrac{\sum m^2 f - \dfrac{(\sum fm)^2}{\sum f}}{\sum f - 1}$

3. Grouped data:

$$\text{Median} = L + \left[\frac{\left(\dfrac{\sum f + 1}{2} \right) - F}{f_m} \right] c$$

4. Grouped data:

$$\text{Mode} = L + \left[\frac{f_m - f_b}{(f_m - f_b) + (f_m - f_a)} \right] c$$

5. Additive Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
6. Complement Rule: $P(A') = 1 - P(A)$
7. Conditional Probability: $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$
8. Discrete Random Variables: $\mu = E(X) = \sum xp(x)$ $E(X^2) = \sum x^2 p(x)$
9. Continuous Random Variable: $\mu = E(X) = \int_{-\infty}^{\infty} xf(x)dx$ $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$
10. Variance of Random Variable: $V(X) = E(X^2) - \mu^2$
11. Binomial Formula: $P(x) = \binom{n}{x} p^x q^{n-x}$
12. Poisson Formula: $P(x) = \dfrac{e^{-\lambda t}(\lambda t)^x}{x!}$
13. Z-score: $z = \dfrac{\text{value - mean}}{\text{standard deviation}} = \dfrac{x - \mu}{\sigma}$
14. Confidence Interval: $C.I. = \bar{x} \pm z\dfrac{\sigma}{\sqrt{n}}$ or $\bar{x} \pm z\dfrac{s}{\sqrt{n}}$